

AMD Projects

Innovate • Transform • Protect

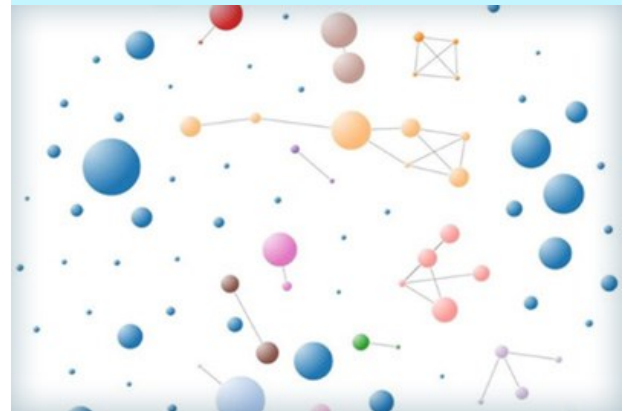
CDC's Advanced Molecular Detection (AMD) program fosters scientific innovation in genomic sequencing, epidemiology, and bioinformatics to transform public health and protect people from disease threats.

AMD Projects: Tracing the Specter of Hepatitis C

GHOST makes connections in hepatitis C virus transmission

Imagine a police surveillance network that allows investigators to enter an individual's fingerprint, and with the click of a button, see a map of all the locations of crimes currently under investigation that are associated with that person. An investigator's dream, right? Well, viral hepatitis researchers are doing just that with technology that is helping them solve the case of hepatitis C outbreaks and improve the public health system's ability to respond and reduce spread of the infection.

Hepatitis C is a contagious liver disease that can cause lifelong illness. It results from infection with the hepatitis C virus (HCV), which is spread primarily through contact with the blood of an infected person. Today, most people become infected with HCV by sharing needles or other equipment to inject drugs. Advances in technology are allowing researchers to identify groups of individuals that have been infected with the same virus, known as transmission clusters, which greatly improves capacity for rapid and effective response.



In GHOST, each circle represents a HCV-infected individual. Two circles are linked if individuals are infected with similar viruses. Larger circles indicate individuals with long-term HCV infections, whereas smaller circles, in general, identify individuals infected more recently. Circles with the same color represent a cluster.



Global Health Outbreak and Surveillance Technology (GHOST) is a new web-based system that harnesses the power of novel bioinformatics technology and automatically performs a comprehensive analysis at the click of a button. Once a user inputs an HCV sample's unique fingerprint, GHOST does a quality control check, identifies transmission links between other virus samples, and automatically creates a simple graph that shows plainly which cases are linked by transmission.

GHOST not only makes the work of researchers easier, it also reduces the cost of molecular testing, making it more affordable to many more laboratories, and increases the rate of detection of HCV transmission in the United States. This modern molecular surveillance of viral hepatitis is likely to be applied to other infectious diseases in the future, and may help establish a platform for effective collaboration and communication across the public health system.

For more information on hepatitis C, please visit the CDC website, www.cdc.gov/hepatitis/index.htm.



2017 Update

In the first two years of this project, CDC made great strides in HCV detection. In this time, researchers transitioned GHOST to faster next generation sequencing (NGS) methods, which also save money over older methods. They also improved the GHOST bioinformatics system to more accurately detect HCV transmission clusters and moved the GHOST website into a cloud-based system, making it easier for state and local public health laboratories to access. While still in development, GHOST demonstrated its value during outbreak investigations, including an HCV outbreak among injection drug users in a rural Indiana community in which people were also infected with HIV-1.

To begin the process of bringing state public health laboratories into GHOST, CDC provided hands-on training in the NGS methods for HCV detection. In 2016, 11 state labs participated in this training and one state began pilot testing use of these methods in their laboratory. Four additional laboratories will begin pilot testing the NGS protocol in 2017. In addition, project investigators plan to open regional GHOST testing centers in 2017, with the first slated for the Appalachian Region where HCV infections are currently high. As work on GHOST continues in 2017, project investigators hope to add tools for hepatitis B (HBV), further expanding our capacity to detect hepatitis disease clusters.